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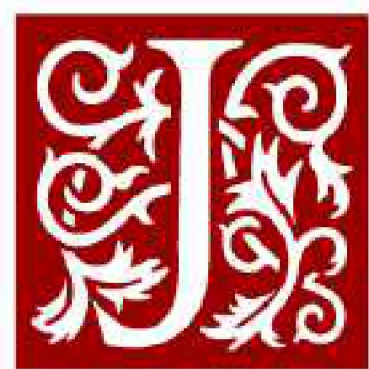
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of format, the two figures correspond far less often in post-1800 books than in earlier ones. It has long been recognized that the format of machine-printed books can frequently (perhaps usually) not be determined from physical evidence,²¹ and bibliographers from McKerrow to Bowers have recommended that, for modern books, the dimensions of a leaf be substituted in the collation line for a designation of format.²²

As bibliographers begin to turn their attention to problems of machine-printed books, various new techniques for ascertaining format may be developed. But at present one of the few techniques available is the analysis of the edges of leaves, a technique which presupposes the existence of an untrimmed copy — indeed, an unopened copy, or at least one opened in such a way that it is still possible to tell which leaves were originally joined at the edges. Such conditions, while not common, are more easily found in nineteenth- and twentieth-century books than in earlier ones, since most modern books have been issued in publishers' bindings and, if issued untrimmed, may still remain so. In the case of an untrimmed — and, preferably, unopened — machine-printed book, one can sometimes work out the format by observing the pattern of joined leaves, or of rough edges where joined leaves have been opened. Using this method Oliver L. Steele has shown that the first edition of *The Scarlet Letter* was printed on double-size sheets, each of which formed two of the eight-leaf quires;²³ the format of the book could thus be described as octavo-form sextodecimo, and the size of the sheet could easily be calculated by multiplying both dimensions of the leaf by four. Steele has also detected in this way the 32° format of Cabell's *Jurgen* and the 64° format of Cabell's *Gallantry* and has recorded the patterns of the edges which can be used to recognize half-sheet imposition of eight-leaf quires in these two common formats.²⁴ One is often not so fortunate, however, in finding untrimmed copies and in working out the format,

21. Charles Evans in 1876 considered it "practically impossible at the present time to correctly define the size of a modern book in the old manner"; see "The Sizes of Printed Books," *Library Journal*, I (1876-77), 58-61.

22. McKerrow, p. 164n.; Bowers, pp. 429-430.

23. Steele, "On the Imposition of the First

Edition of Hawthorne's *The Scarlet Letter*," *Library*, 5th ser., XVII (1962), 250-255. He further demonstrates that the book was printed by half-sheet imposition, with each forme containing the inner and outer sub-formes of a single quire.

24. Steele, "Half-Sheet Imposition of Eight-Leaf Quires in Formes of Thirty-Two and Sixty-Four Pages," *SB*, XV (1962), 274-278.

even with the aid of imposition diagrams in printers' manuals.²⁵ When this approach is not successful, one must search for errors or damage which can reveal format. For instance, if the leading and following edges of a forme receive most stress, examination of the locations of in-press type or plate damage may disclose the imposition and thus the format; Steele has used this technique to demonstrate that Glasgow's *The Wheel of Life* is 32°, with each sheet furnishing two copies of two consecutive eight-leaf gatherings.²⁶ In addition, such rare occurrences as errors in folding the sheets, creases which marred the sheets before folding, and failure to eliminate imposition figures can serve, when available, to help determine format.²⁷ But in many cases the format cannot be established, and the bibliographer must then of necessity allow a leaf measurement to stand as a substitute for an indication of format.

For books of all periods, once a format has been determined, the bibliographer is ready to supply the first element in a description of paper — the specification of the size of the sheet. He simply multiplies the dimensions of the leaf the proper number of times to correspond with the format²⁸ and checks to see whether the resulting dimensions approximate one of the sheet sizes known to have been standard, or at least common, during the period in question. The match can rarely be more than a rough approximation for two reasons: the dimensions of the original sheet can be expected often to be larger than those obtained by multiplying the dimensions of the leaf, since the sheet

25. Practically all of the many printers' manuals published during the nineteenth and twentieth centuries contain imposition diagrams applicable to machine printing; a convenient one for reference is Theodore Low DeVinne's *Modern Methods of Book Composition* (1904), or his *Book Composition*, ed. J. W. Bothwell (1918).

26. Steele, "Evidence of Plate Damage as Applied to the First Impressions of Ellen Glasgow's *The Wheel of Life* (1906)," *SB*, XVI (1963), 223-231; part of his study also consists of an effective statistical analysis of the reliability of the sample of 150 copies which he examined. For some comment on the "leading edge" in modern half-sheet imposition, see Oliver L. Steele, "A Note on Half-Sheet Imposition in Nineteenth and Twentieth Century Books," *Gutenberg Jahrbuch* 1962, pp. 545-547.

27. J. D. Thomas, in "A Modern Instance," *PBSA*, L (1956), 302-304, describes this kind of error in the folding of a sheet in the second edition of Besterman's *World Bibliography of Bibliographies*; and Matthew J. Bruccoli and Charles A. Rheault, in "Imposition Figures and Plate Gangs in *The Rescue*," *SB*, XIV (1961), 258-262, demonstrate the intended 64° format of the second impression of the second edition of Conrad's *The Rescue* through an analysis of the surviving imposition figures which identify the four-page plate gangs.

28. For folio, the shorter dimension of the leaf would be doubled; for quarto, both dimensions would be doubled; for octavo, the shorter would be quadrupled, the longer doubled; and so on.

may have been trimmed in binding (and, in the case of repeatedly rebound older books, trimmed several times); and paper sizes in use at any time have always exhibited numerous variations from the norms, while the norms themselves have shifted from period to period. Nevertheless, the bibliographer, in his role as historian, should attempt to make some correlation between the size he has calculated and one of the sizes actually available at the time.

Despite the considerable amount of historical research on paper,²⁹ information about paper sizes in different periods is not easy to come by. The English paper trade, from at least some time in the seventeenth century,³⁰ has employed a series of names — ranging from “Post” through “Crown” and “Demy” to “Royal” and “Imperial” — to designate sheet sizes, and these names were also common in America³¹ until the twentieth century. Apparently some of the names originally referred to watermarks but gradually came to stand for certain relative sizes of sheets, regardless of what watermarks they bore. Although a great many names have been used at various times, there are only seven of primary importance in connection with paper for printing: Foolscap, Post, Crown, Demy, Medium, Royal, and Imperial. However, with the addition of such adjectives as “Super,” “Large,” “Double,” “Extra,” and the like, a bewildering array of individual designations has been constructed. While the relation of all these names to each other has remained virtually unchanged over the years, the specific measurements attached to each have varied considerably, and the standard sizes adopted by law or agreement in one period are not always retained unaltered by a later generation.

The whole matter is extremely complex, and it seems unrealistic to require of descriptive bibliographers any great precision in the naming of these sizes. Sometimes the differences between two standard

29. The standard general history is Dard Hunter, *Papermaking: The History and Technique of an Ancient Craft* (1943), which includes a highly selective checklist of other historical treatments. Some additional checklists, which can serve as partial guides to the mass of historical research, are mentioned in footnotes 6 and 59; items before 1800 are described in Dard Hunter, *The Literature of Papermaking, 1390-1800* (1925); and work since 1949 can be located through the annual *SB* checklists.

30. See R. W. Chapman, “An Inventory

of Paper, 1674,” *Library*, 4th ser., VII (1926-27), 402-408; cf. Chapman, “Notes on Eighteenth-Century Bookbuilding,” IV (1923-24), 175-177 esp. Allen T. Hazen, in “Eustace Burnaby’s Manufacture of White Paper in England,” *PBSA*, XLVIII (1954), 315-333, reproduces a 1691 announcement of a paper auction, showing many names (but not dimensions) of paper sizes.

31. See the examples from 1821 reported by Lyman Horace Weeks in *A History of Paper-Manufacturing in the United States, 1690-1916* (1916), pp. 119-120.

sizes are small enough that the bibliographer, unsure how much paper has been trimmed off in the copies he has examined, will have no basis for choosing between them; in any case, he cannot always know with certainty the exact dimensions of the sizes available. What seems more reasonable, therefore, is to expect him only to name the general size class to which the sheets he is describing probably belong. It is more meaningful historically to refer to the sheets of a given post-seventeenth-century book as "Crown," if they seem to fall within the range of the sizes which at one time or another have been labeled "Crown," than to attempt to infer the exact measurements of the sheets used, since these inferred measurements may not in fact have been the actual ones. Although many books provide short lists of these English size names, the most useful source for the bibliographer is E. J. Labarre's *Dictionary and Encyclopaedia of Paper and Paper-Making* (2nd ed., 1952), which contains a long table of names (pp. 252-267), arranged alphabetically and giving the various dimensions which have been attached to each name.³² For quick reference, the following brief list may prove convenient. It shows the modern standard and the customary range of variation for the seven basic names, as extracted from Labarre's table and his individual entries for these words; the first figures are inches, those in parentheses millimeters:

	<i>Standard</i>	<i>Variation</i>
Foolscap	17 x 13.5 (431.8 x 342.9)	15 x 12.75 / 18.5 x 14.5 (381 x 323.85 / 469.9 x 368.3)
Post	19 x 15 (482.6 x 381)	18.75 x 15.25 / 20 x 16 (476.25 x 387.35 / 508 x 406.4)
Crown	20 x 15 (508 x 381)	19 x 15 / 20 x 16.5 (482.6 x 381 / 508 x 419.1)
Demy	22.5 x 17.5 (571.5 x 444.5)	18 x 14.5 / 23 x 18 (457.2 x 368.3 / 584.2 x 457.2)
Medium	23 x 18 (584.2 x 457.2)	21 x 16.5 / 24 x 19 (533.4 x 419.1 / 609.6 x 482.6)

32. Bibliographers who consult Labarre's *Dictionary* should also be acquainted with Allan Stevenson's review of it in the *Library*, 5th ser., IX (1954), 59-63, which makes comments on some size-names not included in Labarre. See also E. J. La-

barre, "The Sizes of Paper, Their Names, Origin and History," in *Buch und Papier*, ed. Horst Kunze (1949), pp. 35-54; and E. G. Loeber's *Supplement* (1967) to Labarre's *Dictionary*.

Royal	25 x 20 (635 x 508)	22.25 x 18 / 26 x 20 (565.15 x 457.2 / 660.4 x 508)
Imperial	30 x 22 (762 x 558.8)	28 x 20.5 / 36 x 24 (711.2 x 520.7 / 914.4 x 609.6)

A companion table in Labarre, which may be of even greater initial use to bibliographers, arranges the names in the order of the sizes (pp. 268-272). All the sizes of printing papers recorded in his table are listed below (along with the millimeter equivalents in parentheses) :

15 x 12.5 (381 x 317.5)	Pott
17 x 13.25 (431.8 x 336.55)	Foolscap
17 x 13.5 (431.8 x 342.9)	Large Foolscap
18.5 x 14.5 (469.9 x 368.3)	Small (or Pinched) Post
19 x 15 (482.6 x 381)	Post
20 x 15 (508 x 381)	Crown
20 x 16 (508 x 406.4)	Copy; Tea Copy
20.75 x 14.375 (527.05 x 365.13)	Music Demy; Short
21 x 14 (533.4 x 355.6)	Large Half Royal
21 x 16.5 (533.4 x 419.1)	Large Post
22.5 x 17.5 (571.5 x 444.5)	Demy
23 x 18 (584.2 x 457.2)	Medium
23.5 x 19.5 (596.9 x 495.3)	Sheet-and-a-half Post
24 x 19 (609.6 x 482.6)	Small Royal
25 x 15 (635 x 381)	Double Pott
25 x 20 (635 x 508)	Royal
26.5 x 16.5 (673.1 x 419.1)	Double Foolscap
26.5 x 22.5 (673.1 x 571.5)	Sheet-and-a-half Demy Square
27.5 x 20.5 (698.5 x 520.7)	Super Royal
28 x 21 (711.2 x 533.4)	Double Music
28 x 23 (711.2 x 584.2)	Elephant
29 x 19 (736.6 x 482.6)	Small Double Post
30 x 20 (762 x 508)	Double Crown
30 x 22 (762 x 558.8)	Imperial
30 x 25 (762 x 635)	Quad Pott
30 x 30 (762 x 762)	Sheet-and-a-half Demy Double
	Crown
30.5 x 19 (774.7 x 482.6)	Double Post
33 x 17.75 (838.2 x 450.85)	Sheet-and-a-half Demy Usual
33 x 21 (838.2 x 533.4)	Double Large Post

33 x 22 (838.2 x 558.8)	Large News
34 x 27 (863.6 x 685.8)	Quad Foolscap
35 x 22.5 (889 x 571.5)	Double Demy
36 x 23 (914.4 x 584.2)	Double Medium
38 x 28 (965.2 x 711.2)	Double Globe
40 x 25 (1016 x 635)	Double Royal
40 x 27 (1016 x 685.8)	Double Elephant
40 x 30 (1016 x 762)	Quad Crown
40 x 32 (1016 x 812.8)	Quad Post
41 x 27.5 (1041.4 x 698.5)	Double Super Royal
44 x 30 (1117.6 x 762)	Double Imperial
45 x 35 (1143 x 889)	Quad Demy
50 x 40 (1270 x 1016)	Quad Royal
55 x 31.5 (1397 x 800.1)	Double Atlas
56 x 38 (1422.4 x 965.2)	Quad Globe

The bibliographer who has reason to feel confident that he has determined the exact dimensions of a sheet can, by checking this list, cite a precise name (a basic name with its modifying adjectives).

Although these lists will serve to identify in general terms the sheet sizes of the majority of English and American books since the seventeenth century, they can profitably be supplemented by other tables or sources of information for particular periods. A bibliographer dealing with eighteenth-century books should certainly take advantage of the research of Philip Gaskell and Allan Stevenson, both of whom have worked out tables for that period.³³ At other times one can utilize specimen books which reflect the standard practices of a period. For instance, the book of paper samples issued in 1855 by T. H. Saunders of London gives 151 specimen sheets of handmade, machine-made, and special papers, along with a table of contents providing the name for the size of each sample.³⁴ Modern American paper, following the standardization codified in 1923 by the National Bureau of Standards (and revised in 1932), is not referred to by the traditional English names but simply by the dimensions of the stand-

33. Gaskell, "Notes on Eighteenth Century British Paper," *Library*, 5th ser., XII (1957), 34-42, and *John Baskerville: A Bibliography* (1959), p. xvi; Stevenson, *Catalogue of Botanical Books in the Collection of Rachel McMaster Miller Hunt*, II (1961), ccxxvii. Cf. D. C. Coleman, *The*

British Paper Industry, 1495-1860 (1958), p. 351.

34. A copy of this book, *Illustrations of the British Paper Manufacture*, can be found in the Wing Foundation of The Newberry Library.

ard sheets (millimeters are given here in parentheses):

29 x 26 (736.6 x 660.4)	44 x 33 (1117.6 x 838.2)
32 x 22 (812.8 x 558.8)	44 x 34 (1117.6 x 863.6)
35 x 22.5 (889 x 571.5)	45 x 35 (1143 x 889)
36 x 24 (914.4 x 609.6)	46 x 33 (1168.4 x 838.2)
38 x 25 (965.2 x 635)	48 x 36 (1219.2 x 914.4)
39 x 26 (990.6 x 660.4)	50 x 38 (1270 x 965.2)
40 x 26 (1016 x 660.4)	51 x 41 (1295.4 x 1041.4)
41 x 30.5 (1041.4 x 774.7)	52 x 29 (1320.8 x 736.6)
42 x 28 (1066.8 x 711.2)	56 x 42 (1422.4 x 1066.8)
44 x 28 (1117.6 x 711.2)	56 x 44 (1422.4 x 1117.6)
44 x 32 (1117.6 x 812.8)	64 x 44 (1625.6 x 1117.6)

Foreign paper sizes, though different from the English and American in dimensions and names, are roughly parallel to them, and introductory information on the foreign systems is available in Labarre (pp. 251-252, 282-290) and in Stevenson's table. For books issued during the first two centuries of printing, when paper sizes were less standardized and names had not become attached to particular sizes, the bibliographer can do little more in describing a given book than report the inferred sheet-dimensions of the largest copy known; but in addition he may wish to survey other bibliographies and bibliographical studies³⁵ in order to gain some idea of the sizes prevalent at the time and make some comparative comment. Sometimes an estimate of a sheet size can be made on the basis of the size of the type page and the inner margin³⁶ or on the basis of the location of the tranchefiles, which often appear as chainlines traversing a sheet of paper roughly six or seven millimeters from each end. Regardless of the period, the lengths to which the bibliographer is obliged to go in attempting to establish actual sheet sizes depends on the individual situation — the condition of the books he is describing (whether or not they are uncut or are thought to be only slightly trimmed), taken in conjunction with the characteristics of the period involved (wheth-

35. Such as, for the sizes of fifteenth-century printing paper, Conrad Haebler's *The Study of Incunabula*, trans. Lucy E. Osborne (1933), pp. 49-54.

36. For an illustration of the method, see Curt F. Bühler, "The Margins in Mediaeval Books," *PBSA*, XL (1946), 34-42. Bühler mentions two sizes of medieval

paper, 43 x 32 and 45 x 30 cm.; and he estimates that the average type page was 68% x 45% of the total height of the paper, that the inner margin was 8-10% of it, and that the height of the type page was equal to the breadth of the leaf. Cf. A. W. Pollard, "Margins," *Printing Art*, X (1907-8), 17-24; and "Margins," *Dolphin*, I (1933), 67-80.

er or not paper sizes were standardized or at least fairly regular). When these factors allow the possibility of accuracy in naming the sheet size, the bibliographer ought to do whatever research is necessary to achieve that accuracy; but when, as is more often the case, these factors permit only a rough approximation in specifying the sheet size, the bibliographer can simply refer to such lists as those provided here.

Once the original sheet size is ascertained, either precisely or approximately, the bibliographer has to decide how to enter the information in his description. Since minimum sheet-dimensions can be calculated on the basis of direct measurement of the leaves and since any indication of the original name or size of a sheet is generally an inference based on that direct measurement, the description should emphasize the former (which constitutes demonstrable evidence) rather than the latter (which usually constitutes speculation). An economical way of achieving this emphasis is to begin the description with the demonstrable measurement (the longer dimension preceding the shorter), followed in parentheses by the speculated name or dimensions of the original sheet. When an uncut copy is available for examination, the calculated dimensions and the original dimensions coincide, and the figures can be given without qualification; but when trimmed, or possibly trimmed, copies are the only ones available, the measurements based on the largest examined copy must be prefixed with "at least," or some equivalent phrase, and the inferred name or size with "probably":

- 25 x 20 (Royal) . . .
- 24.5 x 19.5 (a variety of Royal) . . .
- at least 24.5 x 19.5 (probably Royal) . . .
- at least 24.5 x 19.5 (probably Royal, 25 x 20) . . .
- at least 26 x 19.75 (probably a variety of Royal, 26 x 20) . . .
- at least 31 x 21.75 (probably 32 x 22) . . .

Thus the first two examples are based on uncut copies, and the figures can be taken as proved facts; in the first instance the dimensions are exactly those of the standard Royal sheet, but in the second — as the phrase "a variety of Royal" makes clear — they fall within the range historically covered by the name "Royal." The third example, based on a trimmed copy, gives the minimum sheet-dimensions (signaled by "at least"), based on the maximum known leaf-dimensions; since these figures come close to the standard for Royal, one can then add the speculation "probably Royal." If there is additional evidence for judg-

ing the amount cut off, one may wish to include a specific estimate of the dimensions, as in the next two examples. The last illustration represents a trimmed modern American book, with the probable standard sheet size given only in figures and not named. This arrangement of the information not only emphasizes what is factual and subordinates what is conjectural but also provides a standardized form applicable to all circumstances — for whenever a regular or probable size cannot be postulated, as often with early books, the parenthetical comment can simply be eliminated. It goes without saying that, when format itself cannot be established and the leaf-measurement replaces the format abbreviation in the collation line, nothing need be said about size in the paragraph on paper.

Two further problems in the specification of size should be commented on: the degree of accuracy required and the system of measurement to be employed. Questions of accuracy are part of the whole matter of tolerances,³⁷ but in general it can be said that one should follow Bowers's recommendation of measuring leaves to the nearest thirty-second of an inch (*Principles*, p. 431) — or, in the metric system, to the nearest millimeter. In practice, however, only the bibliographer who is intimately acquainted with a particular situation can say just what tolerance is meaningful or appropriate. The presence of deckle edges in an untrimmed copy of a given book may render ridiculous the idea of measuring to the nearest millimeter, though one should attempt, as Bowers suggests, to measure to an imaginary line drawn through the base of the deckle (checking the measurement in several leaves). On the other hand, a situation may arise, in connection with a machine-trimmed book, which requires the bibliographer to take readings to the nearest half-millimeter if he is adequately to distinguish certain states, issues, or impressions.

The question of what system of measurement to use — inches or millimeters — has been discussed in the past³⁸ with inconclusive results. Although the theoretical advantages of the metric system are obvious, English and American bibliographers are accustomed to measuring in inches, and paper sizes in both countries have traditionally been expressed this way. Despite the weight of tradition, it seems desirable to utilize the same system of measurement throughout a bibliographical description, and the metric system has already become established for certain measurements, particularly those relating to

37. For general comments on this subject, see G. T. Tanselle, "Tolerances in Bibliographical Description," *Library*, 5th ser.,

XXIII (1968), 1-12.

38. Cf. Bowers, *Principles*, pp. 308, 430.

typography in incunabula (the dimensions of the type page and the size of the type face as reflected in the measurement of twenty lines). Furthermore, it has been recommended for the typography of all periods,³⁹ and whatever system is adopted for type measurements should certainly be employed for paper measurements also, to facilitate the comparison of type-page size with leaf size. The DIN system of standardized paper sizes, based on the metric system, has been adopted by many countries, and in 1959 the British Standards Institution endorsed it as an alternative to the traditional British system.⁴⁰ There is no question but that, in the field of paper as in most other fields, the general trend in measurement is increasingly toward the metric system. In the light of these considerations, as well as of the inherent convenience of the millimeter as a unit, the bibliographer would be well advised to adopt the metric system.⁴¹ For this reason, the lists given above provide metric equivalents for the usual inch-sizes of paper (1" = 25.4 mm.); if the bibliographer feels awkward in mixing the traditional names with millimeters, he can always include both sets of figures:

635 x 508 (Royal)
or 635 x 508 (Royal; i.e., 25" x 20")

at least 622 x 495 (probably Royal, 635 x 508)
or at least 622 x 495 (probably Royal, 635 x 508 [= 25" x 20'])

39. See G. T. Tanselle, "The Identification of Type Faces in Bibliographical Description," *PBSA*, LX (1966), 185-202. The British Federation of Master Printers has officially adopted the metric system; cf. Eugene M. Ettenberg, "Is Type Measurement Overdue for Change to the Metric System?", *Inland Printer/American Lithographer*, CLXII (January 1969), 48.

40. See British Standard 3176: 1959. Cf. "The DIN System of International Paper Sizes," *British Printer*, LXXI (December 1958), 70-71; "International Standard Paper Sizes — Pipe Dream or Tangible Reality?", *British Printer*, LXXV (June 1962), 107-111; John Tomkins, "DIN — A New, Old Cause," *Typographica*, n.s., no. 5 (June 1962); Labarre, *Dictionary*, pp. 286-287; W. C. Kenneison and A. J. B. Spilman, *Dictionary of Printing, Papermaking and Bookbinding* (1963), pp. 211-213. In the

DIN system, the basic sheet has an area of one square meter, and its dimensions are in the ratio of the side to the diagonal of a square (1:√2) — i.e., 1189 x 841 mm. Such a sheet is referred to as "A₀"; "A₁" is the sheet resulting from a halving of the longer dimension (841 x 594); "A₂" from another halving (594 x 420), and so on. A "B" series (based on a 1414 x 1000 sheet) establishes intermediate sizes between those of the "A" series; long sizes may be specified in terms of a fraction of a standard size, as "1/4 A₄" (210 x 74).

41. The printed catalogue cards prepared by the Library of Congress express the height of books and the dimensions of broadsides in centimeters, and these practices are recommended in the *Anglo-American Cataloging Rules* (North American Text, 1967), pp. 210-211.

The Bibliographical Description of Paper

by

G. THOMAS TANSELLE

ONE OF THE PECULIARITIES IN THE HISTORICAL DEVELOPMENT of descriptive bibliography has been the small attention paid to paper. Since paper and inked type-impressions are the two principal physical ingredients of a book and since paper is the one which gives a book its most obvious physical characteristics (shape, size, weight, bulk), it would seem natural for a description of paper to occupy a prominent position in any description of a book. Yet the majority of descriptive bibliographies of the past make no mention of paper, except the indirect references afforded by an indication of format or leaf measurement. Those that do include some description of paper generally provide no more than a few words, such as "Wove paper, unwatermarked" or "Printed on white wove paper."¹ Some, like Fred H. Higginson's *A Bibliography of the Works of Robert Graves* (1966), offer bulk measurements and careful descriptions of watermarks. And occasionally a bibliography which does not give particular attention to paper recognizes its usefulness for analysis and identification, as when Karl Yost distinguishes the first printing of Millay's *Renascence* by the "AGM Glaslan" watermark² or when Donald Gallup says of Eliot's *The Dry Salvages*, "Late copies of the first impression are printed on slightly thicker paper without the watermark ADELPHI."³ But it is safe to say that most descriptive bibliographies — including many classic ones — make no attempt to record the nature of the paper used in the books under examination.

1. These quotations happen to have been taken from, respectively, Alfred P. Lee's *A Bibliography of Christopher Morley* (1935), p. 31, and Dorothy R. Russo and Thelma L. Sullivan's *A Bibliography of Booth Tarkington* (1949), p. 36. But similar phrases are found in a number of

other bibliographies.

2. Yost, *A Bibliography of the Works of Edna St. Vincent Millay* (1937), entry 3.

3. Gallup, *T. S. Eliot: A Bibliography* (1952), entry A39.

Inserting the inch measurements should eliminate any objection to the historical inappropriateness of associating the metric system with the size names; and the slight inconvenience of making the adjustment is far outweighed by the advantages gained in the ease with which the figures can be manipulated and compared with others in the description.

II

After the specification of the size of the sheet, the next fact to be recorded in a description of paper is an indication of the markings in the sheet — chainlines and watermarks. An adequate accounting of these features involves (1) stating whether the paper is laid or wove and, if laid, measuring the distance between the chainlines;⁴² and (2) describing any marks present (watermarks or countermarks), identifying them if possible. All paper before approximately 1756 was “laid” — that is, made in moulds, the bottoms of which consisted of wires parallel to the longer dimension and crossed perpendicularly at wider intervals by heavier chains. After that date, with the introduction of moulds containing a finely woven wire mesh, “wove” paper (which bears no easily discernible crossing lines) was possible, though it did not come into wide use until near the end of the century.⁴³ Nineteenth- and twentieth-century machine-made paper can also be classified as “laid” or “wove,” but the terms in this connection refer only to patterns impressed on the paper, since those patterns are not the result of anything functional in the manufacturing process. In the bibliographical description of pre-1800 books, therefore, it is unnecessary to specify the paper as “laid”: any paper not specifically labeled can be assumed to be laid, and those late eighteenth-century instances of wove paper can be explicitly marked “wove.” Strictly speaking, the mention of “laid” is superfluous even for later paper, since the indication of the distance between the chainlines makes clear the fact that the paper has a laid pattern; nevertheless, since the laid pattern is no longer predominant, it is probably more sensible in post-1800 books to specify “laid” or “wove” in each instance. For

42. The direction of the chainlines in the sheet need not be mentioned unless it is unusual; the direction of the chainlines in the leaf — like other facts about the folded form of the sheets — should be recorded later, at the end of the paragraph on paper.

43. See A. T. Hazen, “Baskerville and James Whatman,” *SB*, V (1952-53), 187-189; and Thomas Balston, *William Balston, Paper Maker, 1759-1849* (1954), *James Whatman, Father and Son* (1957), and “Whatman Paper in a Book Dated 1757,” *Book Collector*, VIII (1959), 306-308.

books of all periods, if there is no watermark, this part of the description is quite simple: it consists either of the single word "wove" or of a phrase such as "laid, chainlines 18 mm. apart."⁴⁴ Of course, "unwatermarked" is understood in each case, but it does no harm to add the word "unwatermarked" (or "unmarked") after the words "wove" and "laid."

When a watermark is present, it is the bibliographer's duty to provide as accurate a description of it as possible, following the general procedure which he would use in describing any other kind of pattern⁴⁵ — that is, a combination of a verbal statement with a reference to a visual standard. The verbal statement may be expanded or contracted according to the relative accuracy and accessibility of the illustration cited as a standard, but certain minimum information should always be included: a brief indication of the general form of the mark (as "crown" or "bull's head") and a measurement of the maximum height and width of the mark (with the height preceding the width).⁴⁶ Allan Stevenson has suggested a convenient system for recording such measurements so that they reveal, at the same time, the distance between the chainlines and the position of the watermark in relation to the chainlines.⁴⁷ In this system, whichever dimension of the watermark crosses the chainlines is recorded in brackets, with the distance to the nearest chainline on either side entered on each side of the brackets. Thus the notation "6[28]4" would mean that the mark is 28 mm. wide at its widest point, with one chainline running 6 mm. to the left and another 4 mm. to the right, when the mark is viewed "right side up" and from the mould side of the sheet (the side with the indentations from the chains and wires); and the chainlines would be 38 mm. apart. If a chainline cuts through the watermark, the bracketed measurement can be divided with a vertical stroke at the proper place: thus in "6[13|15]4," the chainlines are 19 mm. apart, and one of them runs through the watermark 13 mm. from one side and 15 mm. from the opposite side. It is frequently unneces-

44. The importance of chainlines for bibliographical analysis in tests for cancels and conjugacy — not simply their distance apart but also the leaf-patterns of mould- and felt-sides as revealed by the indentations of chainlines — is discussed by Allan Stevenson in "Chain-Indentations in Paper as Evidence," *SB*, VI (1954), 181-195.

45. See G. T. Tanselle, "The Bibliographical Description of Patterns," *SB*, XXIII

(1970), 71-102.

46. "Height" and "width" here refer to the mark itself; for some marks, therefore, the larger figure will appear second.

47. "Paper as Bibliographical Evidence," *Library*, 5th ser., XVII (1962), 200. An example of the use of chain-space measurements is Stevenson's "Tudor Roses from John Tate," *SB*, XX (1967), 15-34.

sary, therefore, to specify separately the distance between chainlines, since this system of watermark measurement includes that information and, in addition, shows the relationship between the two measurements:

laid, with bull's head tau mark, $49 \times 4[13|10]7$

In this example the chainlines are 17 mm. apart, and it would be superfluous to add a phrase explicitly saying so. For machine-made papers, however, the relationship between the laid pattern and the watermark is less important, and it may seem more sensible in some instances — particularly when the watermark appears several times in a sheet in different positions relative to the chainlines — to give the measurements separately:

laid, with mark reading 'WARREN'S | OLDE STYLE',

$40 \times 8[16|24|24|20]4$

or laid, chainlines 24 mm. apart, with mark reading 'WARREN'S | OLDE STYLE', 40×84

In handmade papers, on the other hand, any difference in the position of a watermark relative to the adjacent chainlines provides significant evidence for bibliographical analysis, and the variation should always be noted:⁴⁸

bull's head tau mark, $49 \times 5[28]5/4[28]6$

It is also a good idea, for purposes of documentation, to cite after every measurement a leaf (or leaves) which provides an example of the watermark with the specified measurements:

bull's head tau mark, $49 \times 5[28]5 (B_4)/4[28]6 (G_4)$

Watermarks obviously will be easier to measure in some formats than in others — indeed, when handmade papers are involved, folio is generally the only format in which one can measure the entire watermark at one time. Nevertheless, it is often possible to construct an accurate measurement by piecing together the measurements of the portions of the watermark visible in various leaves; but when too much of the watermark is hidden in the gutter of a tightly bound volume or has been trimmed off in the process of binding, an ap-

48. Since moulds were regularly used in pairs (see below, note 51), the presence of companion watermarks need not be specifically mentioned; however, a difference

between the two can be conveniently recorded in this fashion: "bull's head tau mark, (I) $49 \times 5[28]5$, (II) $49 \times 4[28]6$."

proximate measurement must be given, preceded by some such notation as "at least" or "about."

Following the verbal description of the watermark should come a parenthetical reference to an illustration of that mark. Such a reference is an important part of the bibliographer's responsibility: it helpfully supplements the verbal description, since some users of a bibliography may require, in particular instances, a more precise idea of the design than can manageably be expressed in words and figures; and it places the mark in a larger historical context through associating it with a published illustration which has been (or can be) cited by other bibliographers under similar circumstances. A number of large compilations of tracings of watermarks have been published; when the bibliographer locates in one of them a tracing which is identical with (or closely resembles) the mark in question, he can enter the name of the work and the tracing number in his description. If no standard collection of tracings seems to include the mark, the bibliographer can provide an illustration in his own section of illustrations (and the parenthetical reference would then be simply to this illustration in the same volume). It is usually preferable in descriptive bibliography, when one is dealing with designs or patterns, to cite whenever possible a separately published standard rather than an illustration provided for the particular occasion. With watermarks, however, the situation is different. Since tracings are inadequate for modern bibliographical analysis of watermarks, a reference to a tracing is less helpful than a reproduction of a good photograph of a watermark. If large collections of photographs of watermarks were available in published form, it would often be unnecessary to provide individual photographs; but since no such reference works exist at present, a bibliographer who furnishes photographs of watermarks, far from creating an unnecessary proliferation, is usefully contributing to the meager published supply. These considerations are not meant to suggest that there is no point in referring to the standard collections of tracings, for they have their uses: they assist in classifying watermarks; they provide approximate representations of a large number of marks; and they furnish leads for additional research. Citations of published tracings are, therefore, still appropriate; but, ideally, reference should also be made to photographs.

To understand why tracings are inadequate — in fact, to make any positive identification of a watermark at all — the descriptive bibliographer must be familiar with the revolutionary techniques which Allan Stevenson has developed for analyzing watermarks. In a series

of brilliant articles beginning in the late 1940's, he demonstrated some of the ways, unrecognized before, in which watermarks can furnish evidence for bibliographical analysis;⁴⁹ the monument of the method, his book on *The Problem of the Missale speciale* (1967), draws all these techniques together and uses them to solve a celebrated problem.⁵⁰ As a result of his work, analysis of watermarks is now an established bibliographical tool, and no bibliographer can be said to have examined a book properly without giving its paper the same careful attention which has long been accorded to typographic matters. Stevenson's method stems from the basic discovery that individual watermarks can be positively identified by their "sewing dots." In the mould, the watermark pieces were attached to the wires and chains by means of thin wire thread; at each of the points where the watermark was fastened, this thread formed a small lump which left its mark in the finished paper as if it were part of the design itself. Since only a remote coincidence could result in any two watermarks of the same design being attached to the wires and chains at exactly the same spots with the same relative amounts of thread, examination of the patterns of sewing dots can provide conclusive identification of the mould in which a given piece of paper was produced. Moulds were regularly used in pairs with supposedly identical watermarks,⁵¹ and many pairs, unrelated to each other, contain quite similar designs; but analysis of the sewing dots can distinguish between individual moulds in every instance. Tracings are not detailed enough for this kind of research, whereas photographs⁵² — or, preferably, beta-radiographs⁵³ which reproduce watermarks without reproducing the inked

49. See especially *Observations on Paper as Evidence* (1961), and "Paper as Bibliographical Evidence," *Library*, 5th ser., XVII (1962), 197-212; for a brief statement, see "The Natural History of Watermarks," in C. M. Briquet, *Les Filigranes*, ed. Stevenson (1968), pp. *20-23. In one of his earlier articles, he demonstrated how watermarks can be useful in the detection and analysis of press variants, the sequence of formes through the press, and related problems: "New Uses of Watermarks as Bibliographical Evidence," *SB*, I (1948-49), 151-182. For his discussion of chainlines, see above, note 44.

50. A condensed version of the argument appears in his "Paper Evidence and the *Missale speciale*," *Gutenberg Jahrbuch*

1962, pp. 93-105.

51. Stevenson, "Watermarks Are Twins," *SB*, IV (1951-52), 57-91.

52. See T. Gerardy, "Die Fotografische Registrierung von Wasserzeichen," *Papiergeschichte*, XVI (December 1966), 22-25. The use of sensitized paper to make direct photographs of watermarks was suggested at least as early as 1904 by Gilbert R. Redgrave, in "The Water-Marks in Paper," *Library*, 2nd ser., V (1904), 91-92.

53. See J. S. G. Simmons, "The Leningrad Method of Watermark Reproduction," *Book Collector*, X (1961), 329-330, which describes the method first announced in 1960 by D. P. Erastov and also used in J.

type-impressions over them — can be better for study than the paper itself. Indeed, the future of watermark study lies in radiography, and the student of paper will need to carry with him a Carbon 14 source.

Stevenson has further shown how variant states of individual watermarks can be recognized and employed for such purposes as dating. As a mould was used, some of the threads would loosen or break and allow the watermark to slip or to bend out of shape; and periodically, as this deterioration was noticed, it would be repaired, but the repaired state would not be identical with the original state. Therefore, by examining sewing dots, one can not only identify a watermark but also place any state of it chronologically in relation to another state of the same watermark; in other words, one can distinguish variations which signify separate watermarks from those which merely constitute states of a single watermark. Since the life of a mould in normal use was about a year, and since long runs of paper in a book are more significant for dating than stray remnants which the printer may have had on hand for a considerable time, one is sometimes able, by combining all the evidence, to date a book with remarkable precision — just as Stevenson assigns the *Missale* to 1473, probably between February and October.

The descriptive bibliographer cannot be expected to consider an extensive investigation of watermarks — of the kind Stevenson performed for the *Missale* — a routine part of his description of every book. What should be expected is that he be aware of the techniques at his disposal; that he employ them whenever necessary to establish, or assist in establishing, basic facts in the printing and publishing history of a book; and that in every case his ordinary description of paper reveal his awareness of the needs of bibliographers who employ these techniques. For example, providing the measurements of a watermark in addition to a brief verbal description helps in itself to distinguish among similar watermark designs; but if the bibliographer also includes in his figures the relation of the watermark to the chain-lines, he is, in brief space and with little additional effort, offering a fact of great potential usefulness to those engaged in paper study.

L. Putman's *Isotopes* (1960); O. K. Nordstrand, "Beta-Radiographie von Wasserzeichen," *Papiergeschichte*, XVII (1967), 25-28; Stevenson, *Problem*, pp. 66-68; Stevenson, "Beta-Radiography and Paper Research," in *VII International Congress of Paper Historians Communications* (1967), pp. 159-168; Stevenson, "Watermark Beta-

Radiographs," in his edition of C. M. Briquet's *Les Filigranes* (1968), following p. *36; *Papermaking: Art and Craft* (Library of Congress, 1968), pp. 72-77; and J. S. G. Simmons, "The Delft Method of Watermark Reproduction," *Book Collector*, XVIII (1969), 514-515.

Since the watermark ordinarily slipped to the right in the mould (to the left on the sheet, viewed from the mould side), observation of the shifting distances between the watermark and the adjacent chainlines can help to establish a sequence of successive states of the watermark.⁵⁴ Such evidence must eventually be used in conjunction with that from sewing dots; but since the precise locations of sewing dots cannot be indicated conveniently or accurately in words or numbers and since the locations of the chainlines in relation to the watermarks can be so indicated, the descriptive bibliographer is in a position to supply at least this much initial data about watermark states. The fact that he does not find it necessary, in terms of the book he is describing, to pursue the investigation of the watermark further does not mean that another bibliographer, dealing with a different book which may have been printed on the same paper, will not be greatly assisted by the information. The second bibliographer will no doubt have to look at the paper himself, but the point is that the first man's bibliography served as a guide telling him where he could go to find some paper relevant to his own study. As more bibliographies include this kind of information, the mass of accumulated data will become increasingly useful, and bibliographies will be fulfilling all the more successfully their role as storehouses of information on the bookmaking practices of a given period.

The identification of a watermark, as Stevenson has revealed, involves more than the location of a similar mark in one of the published collections of tracings. But the bibliographer who understands the limitations of such collections will also know how to utilize them intelligently, and providing references to these collections must remain a requirement of any description of a watermark. Stevenson has offered good instruction in this area by explaining how to use Briquet's *Les Filigranes* in his introduction to the Paper Publications Society's magnificent edition of that work (1968).⁵⁵ The bibliographer cannot claim to have done his basic research if he has not attempted to locate any watermark he describes in the relevant published collections. The largest and most famous is Charles M. Briquet's *Les Filigranes* (1907), with its 16,112 tracings; but since it does not extend beyond 1600 and does not cover Spain, Portugal, Scandinavia, and Britain, the bibliographer must expect to turn to other collections as well and should be familiar with the most important ones. The Paper

54. Stevenson, *Problem*, pp. 248-252.

Future of Paper Studies," in Briquet's *Opuscula* (1955), pp. xv-l.

55. See also his essay on "Briquet and the

Publications Society, founded in Hilversum, Holland, in 1948 by E. J. Labarre, has performed an invaluable service both in fostering the production of new works on watermarks and in reprinting older ones with masterful commentary and annotation. Its edition of Briquet, for example, contains 151 large pages of supplementary material, including many pages of addenda and corrigenda; and the wealth of information available in its main series of volumes, the "Monumenta Chartae Papyraceae Historiam Illustrantia," should not be overlooked by any descriptive bibliographer. Students of English books should in particular know the following works, two of which were issued by the Paper Publications Society (PPS):

Edward Heawood, "Sources of Early English Paper-Supply," *Library*, 4th ser., X (1929-30), 282-307, 427-454; "Papers Used in England after 1600," XI (1930-31), 263-299, 466-498; "Further Notes on Paper Used in England after 1600," 5th ser., II (1947-48), 119-149; III (1948-49), 141-142. [567 tracings]⁵⁶

W. A. Churchill, *Watermarks in Paper in Holland, England, France, etc., in the XVII and XVIII Centuries and Their Interconnection* (1935). [578 tracings]

Edward Heawood, *Watermarks, Mainly of the 17th and 18th Centuries* (PPS, 1950). [4078 tracings]⁵⁷

Alfred H. Shorter, *Paper Mills and Paper Makers in England, 1495-1800* (PPS, 1957). [217 tracings]

But since a large proportion of English books before the seventeenth century were printed on imported papers, the bibliographer of these books must also be acquainted with Briquet; and bibliographers in general should also know the principal foreign collections, at least the ones brought out by the Paper Publications Society — those by Zonghi, Eineder, Uchastkina, Lindt, Tromonin, Bofarull y Sans, and Voorn, and *The Nostitz Papers* — and a few others such as Midoux-Matton, LeClert, Nicolaï, Piekosinski, Klepikov, and Likhachev.⁵⁸ When it is

56. Heawood's article on "Watermarks," in Labarre's *Dictionary*, pp. 328-360, is a useful introductory survey, but its tracings are less appropriate for bibliographical citation.

57. In using this work, one should consult Allan Stevenson, "A Critical Study of Heawood's

Watermarks, Mainly of the 17th and 18th Centuries," *PBSA*, XLV (1951), 23-36.

58. At the back of Dard Hunter's *Paper-making in Pioneer America* (1952) are some good photographs of early American marks.

necessary to go beyond these works, a convenient list to consult is E. J. Labarre's *A Short Guide to Books on Watermarks* (1955),⁵⁹ which describes 82 titles.

A bibliographer, finding in one of these books a tracing which corresponds to the watermark in question, enters the name of the author and the serial number of the tracing in his description; if he provides a photograph of his own, his primary reference is to that photograph, with an added note asking the reader to compare certain published tracings:

dolphin mark (Briquet 5873), 35 x 1[23]1 (C4)
or dolphin mark (Plate 7; cf. Briquet 5873), 35 x 1[23]1 (C4)

Since tracings are never exact reproductions, it is unnecessary to use "cf." when the only reference is to one tracing (though it may be prudent to do so).⁶⁰ When the match is so inexact that nothing more specific than a whole class of marks can be cited, the "cf." can conveniently be used with the inclusive numbers referring to that class; it can also be employed when two or more individual tracings are cited, as a way of indicating the less exact of them. The brevity and wording of the verbal description are to some extent determined by the citations. If there are no citations of published tracings — either because the watermark is in modern machine-made paper or because, even though earlier, it does not correspond with any located tracing — the verbal description must be more ample than would otherwise be necessary; but if a tracing is cited or a specific photograph is provided, the verbal description can be quite brief. The form of the wording, however, should in all cases conform as much as possible to an accepted standard, so that the same figures will not be called different names by different bibliographers. A. F. Gasparinetti has suggested, to bring about this uniformity, that Briquet's terms (or their equivalents in other languages) be used, even when one is

59. Reprinted in *The Nostitz Papers* (1956), pp. xxxvii-xlii, and in *Philobiblon*, I (1957), 237-251. Another important list of material, limited to the period before 1600, is in C. M. Briquet, *Les Filigranes*, ed. Stevenson (1968), pp. *37-53; an earlier list is Dard Hunter, *Handmade Paper and Its Watermarks: A Bibliography* (1916). See also E. J. Labarre, "The Study of Watermarks in Great Britain," in *The Briquet*

Album (1952), pp. 97-106.

60. Stevenson, in the *Hunt Catalogue*, uses "cf." and also explains concisely its significance: "The references to Heawood, Churchill, Voorn, Nicolaï, and others are not to marks from the same moulds (which are difficult to be sure of from tracings) but to sufficiently similar marks for the reader's understanding" (p. cixxix).

referring to other works.⁶¹ The proposal is sensible, since Briquet's collection is the largest and since the equivalents of his French terms have been provided in several languages both in *The Briquet Album* and in the 1968 edition of *Les Filigranes*.⁶² Longer verbal descriptions, when required to compensate for the lack of citations, need not be elaborate but should always include quasi-facsimile transcriptions of words or numbers; when the situation warrants, of course, more detailed treatment can be furnished, either as an appendage to the paragraph on paper or in the "Notes" section. Any countermarks or subsidiary marks can be recorded in exactly the same way as the main marks. Stevenson, in the *Hunt Catalogue*, employs a long equals sign between the description of a main mark and that of a countermark;⁶³ the device is convenient, but, if one wishes to use words instead, one can simply insert "countermark" ("cornermark," "edgemark") or "countermark reading":

dolphin mark (Briquet 5873), 35 x 1[23]1 (C4) = 'IV', 10 x 6[13]6 (C1)
 or dolphin mark (Briquet 5873), 35 x 1[23]1 (C4), and countermark 'IV', 10 x 6[13]6 (C1)

This treatment of watermarks, countermarks, and chainlines is not time-consuming and requires little space in the final description; yet it provides essential information for an identification of paper and records facts of potential significance for further bibliographical analysis.

III

In addition to the dimensions and the markings, there are many other characteristics of paper which the bibliographer could conceivably take into account. The paper industry has developed a wide range of procedures and machines for testing various properties of paper in order to maintain standards and to identify precisely the features of any given sample. Although these tests are usually applied to modern machine-made paper, they could be employed to ascertain the characteristics of earlier papers as well. Some of them are not

61. Gasparinetti, "On the Adoption of a Universal Terminology for Watermarks," in *The Briquet Album*, pp. 122-124.

62. *The Briquet Album*, pp. 125-154 (English, German, Italian); *Les Filigranes*, pp. *109-131 (French, English, German).

63. Gaskell, in the *Baskerville bibliography*, uses an oblique line for this purpose; oblique lines have been suggested above, however, as separators for variant measurements.

There are several reasons for this situation. In the first place, the bibliographical interest in type-impressions has tended to deflect bibliographers' attention from the paper on which those impressions appear. It was natural that early bibliographers should have regarded type-impressions as the more promising field for analysis, since there are many immediately apparent impressions on every page and since the possibilities for variation in their arrangement, in the design of individual letters, and in the damage suffered by individual types are infinite. Because the nineteenth-century incunabulists found the analysis of type faces to be an effective tool in the identification of printers and the classification of editions, a concise description of type faces became a standard part of their descriptions of the books. Following in this tradition, bibliographers of Renaissance books have discovered important information about the printing of the books through elaborate analysis of typography and damaged types — information which, in turn, has a bearing on the establishment of texts. Furthermore, the natural interest in the text of a book serves in itself to call attention to typographical features, for the eye in reading observes the type-impressions more directly than the paper. As a result, misprints, broken types, or other typographical peculiarities which may serve to distinguish issues, states, or impressions are noticed and reported more frequently than the distinguishing features of paper. Given the historical evolution of analytical bibliography, descriptive bibliography, and editing, it is not difficult to see why typographical evidence has entered into descriptive bibliographies to a larger extent than have details about paper.⁴

Another factor is the tradition of book collecting out of which descriptive bibliography grew. Some descriptive bibliographies—aimed primarily at collectors — have concentrated on those points which distinguish first impressions (or states or issues of first impressions). In the case of books issued in publishers' bindings or casings, one result has been an emphasis on the description of bindings and endpapers. Since publishers frequently do not bind all copies of an impression at one time but instead bind small batches as required, variant states of bindings are common occurrences, especially on nineteenth-century books; when priority can be established, collectors are often concerned with knowing the characteristics by which the earliest copies can be identified. The upshot is the absurd — but extremely common — situation in which a bibliographer describes the endpapers of a book, the

4. Although actual descriptions of type are not common in bibliographies of post-incunabular books.

appropriate for bibliographical work, but the bibliographer should be aware of the general range of physical, chemical, and optical characteristics which are mechanically testable. The physical characteristics can be subdivided into five categories: (1) substance, involving such matters as basis weight, thickness, bulk, and bulking thickness; (2) strength, as revealed by tests for tensile strength (e.g., Schopper static tester, Van der Korput dynamic tester), bursting tests (Mullen, Schopper-Dalen), tearing tests (Elmendorf), and folding tests (Schopper); (3) permeability and absorbency (as tested by the Gurley densometer, the Potts permeability apparatus, the Cobb method, the Currier apparatus, and so on); (4) formation (as indicated by the degree of uniformity of transmitted light); and (5) smoothness (judged by microscopic or photographic techniques or by the flow of air between the paper and a standard surface). The chemical characteristics can be determined by tests for (1) the fiber and mineral constituents of a furnish; (2) the sizing agents (gelatin, rosin, casein); and (3) acidity and alkalinity (both colorimetric and electrometric tests). Finally, the optical properties fall into three groups: (1) color (tested against a standard or by spectrophotometer) and whiteness (tested by the Zeiss Leukometer); (2) gloss (surface reflectance measured by such instruments as the Ingersol Glarimeter or the Sheen Gloss meter) and brightness (General Electric Brightness meter or Institute for Paper Chemistry Automatic Color and Brightness Tester); and (3) opacity (measured by a photometer).⁶⁴

Some of these tests can be ruled out immediately for bibliographical purposes because they entail destruction or mutilation of the

64. The basic tests for paper are outlined in any of the standard works on paper manufacture. See, for example, Julius Grant, *A Laboratory Handbook of Pulp and Paper Manufacture* (1942), pp. 179-297 (which includes a good analysis of the appearance of fibers, pp. 251-258); Robert H. Clapperton, *Modern Paper-Making* (3rd ed., 1952), pp. 450-464; J. Newell Stephenson (ed.), *Manufacture and Testing of Paper and Board* (1953); C. Earl Libby (ed.), *Pulp and Paper Science and Technology* (1962), II, 373-398; Robert R. A. Higham, *A Handbook of Papermaking* (1963), pp. 72-86; and Victor Strauss, *The Printing Industry* (1967), pp. 577-580. An important introduction to the subject of paper testing is *Paper and Paperboard:*

Characteristics, Nomenclature and Significance of Tests (ASTM Special Technical Publication No. 60-B; 3rd ed., 1963); it provides, at the beginning, a list showing the correspondences between the two sets of test standards, those of the American Society for Testing and Materials (ASTM) and those of the Technical Association of the Pulp and Paper Industry (TAPPI). The ASTM standards are set forth in Part 15 of the *Book of ASTM Standards*, issued annually; the TAPPI *Standard Testing Procedures* are available in two loose-leaf volumes, revised continually. *A Bibliography of Paper Testing* appears in the Institute of Paper Chemistry Bibliographic Series as Nos. 154-156 (2nd ed., 1954, with supplements in 1960 and 1965) and Nos. 157-159 (2nd ed., 1960).

paper (all the tests for strength fall into this category). Others, though they do not damage the paper, are impractical for a bibliographer to undertake because they involve precision instruments which are not easily portable and are not available in libraries (many of the optical tests fall into this category). In any case, the details established by most of these tests are not of primary relevance to bibliographical studies. Since a verbal description of a physical object necessarily represents a selection of details out of an infinite number of possible details, an intelligent description depends on a systematic selection of details made in the light of the purposes for which the description is intended. The elaborate tests performed in the paper industry do not provide exhaustive coverage of every conceivable property of paper, but they furnish those details necessary for the efficient operation of the industry. Similarly, the description of paper in a bibliography should record only those characteristics which are of primary interest to the persons for whom the bibliography is prepared—in general, students of literature, of history, and of printing and publishing. One cannot, of course, say that such details as the tensile strength or the chemical composition or the opacity of paper are necessarily irrelevant to historical study; the student of book production in a particular period would doubtless be happy to have a large body of such information available for his use in author-bibliographies. But one can say that these kinds of detail are not of primary importance to the majority of users of a bibliography and that the practical difficulties they involve outweigh their usefulness for this audience. If, in certain instances, some of these details do turn out to be of significance in establishing the printing history of a book, they can then be recorded — the classic case is Carter and Pollard's use of evidence regarding the composition of paper in detecting the Wise forgeries. Only the bibliographer who has a detailed knowledge of a particular situation will be in a position to decide whether or not some of these tests are likely to be fruitful for his purposes; when he thinks they may be, he can turn for assistance to an appropriate laboratory, but it would be absurd to require him to go to such lengths as part of the ordinary routine of bibliographical description.⁶⁵ In the light of these considerations, only two of the tests employed in the paper trade — those for thickness and color — seem appropriate for bibliographical use, while a third group of the tested characteristics — those relating to finish — can be treated bibliographically in a less precise fashion.

65. Cf. Tanselle, "Tolerances," pp. 5-6.

(1) *Thickness.* The measurement of paper thickness is one of several related measurements of primary importance in the paper industry. Of these, the basic measurement is that of the “substance” of paper, generally expressed in terms of “basis weight” — that is, the weight per standard unit area (usually, per ream of specified dimensions).⁶⁶ Thus the designation “35 x 45, 100 lbs., 516’s” describes a paper of which a 516-sheet ream, with each sheet measuring 35 x 45 inches, weighs 100 pounds. A more convenient method of indicating substance, based on the metric system, is to specify grams per square meter; in this way only one figure need be given, since it is not dependent on the size of the sheet. Instead of saying “35 x 45, 100 lbs., 516’s,” one can simply say “87 g.s.m.”⁶⁷ Although the substance of paper is one of its most prominent characteristics, measurement of substance cannot normally be performed in bibliographical work, since the bibliographer is not usually in a position to weigh the sheets of a book separately from the binding, endpapers, and inserted plates. If he cannot make this measurement, then he cannot present other figures based on it, such as “bulk,” the ratio of the thickness of a sheet to its substance.⁶⁸ The thickness of a sheet, on the other hand, is not obscured when the sheet is folded and bound into a book; it is thus available for direct measurement by the bibliographer, and it should be reported in his description of paper.

Measurement of the thickness of a single sheet of paper is performed with a micrometer caliper. Many styles of micrometers are available (both spring-actuated and dead-weight-actuated), and most of them can be used for measuring paper thickness; since suitable pocket models can be purchased for about \$30, every bibliographer should have one as part of his standard equipment.⁶⁹ They are manufactured with dials graduated in fractions of inches or in fractions of millimeters, and the bibliographer should choose one with a dial corresponding to whichever system is being used for other measure-

66. See TAPPI Method T410-08 and ASTM Method D646.

67. Tables of equivalences, for converting pounds per ream to grams per square meter, are available; see, for example, Clapperton, *Modern Paper-Making*, pp. 496-497.

68. The term “bulk” is also used to mean the total thickness of a given number of sheets, and it is in this sense that the word

may appear later in a bibliographical description of paper to indicate the combined thickness of the folded sheets in a finished book.

69. Micrometers for official paper testing must conform with TAPPI Method 7411-m44 and ASTM Method D645-64T and have .0001” graduation; but most dial micrometers with .001” graduation are adequate for bibliographical work.

ments.⁷⁰ The sheets of a given book may vary in thickness, according to the micrometer readings, and the significance of such variation may differ according to the period and type of paper. In handmade paper, if the chainlines and watermark suggest that all the sheets were intended to be "the same paper," certain variations in thickness may be of no importance, and one can report either an average reading or the range of readings; but in machine-made paper a slight difference in thickness between two sheets can indicate that two stocks of paper were used and may even be important in distinguishing between two impressions.⁷¹ Therefore, one should normally take a micrometer reading on one leaf in every sheet (if not on every leaf, as a test for cancels). When a representative reading for each paper is arrived at, one simply records the reading in the description, along with the citation of a specific leaf which yields that reading, in some such form as the following: "thickness .003 in. (B3)," or "thickness .076 mm. (B3)," or "thickness 76 μ (B3)."⁷²

Some bibliographers in the past have reported the thickness of all the sheets of a book taken together, in such a form as "sheets bulk 1 7/16 in." This kind of measurement is useful in enabling a reader to visualize the thickness of a book and serves as a guide to the "bulking thickness" of the paper. When the figure for the total thickness of the leaves of a book is divided by the number of leaves, the resulting figure is nearly always larger than that representing the thickness of a single sheet as measured with a micrometer; this larger figure is known as the "bulking thickness" and is an important characteristic of paper. For these reasons the bibliographer should continue to record the total bulk of the sheets (and perhaps the calculated bulking thickness of a single sheet), even though a micrometer reading of the paper thickness is given also. Such a measurement, however, is often not very precise because it can vary with the amount of pressure applied to the sheets when the measurement is taken and with the

70. A convenient pocket micrometer, satisfactory for bibliographical purposes, is the Ames Thickness Measure No. 25 (with .001" graduation) or No. 25M (with .01 mm. graduation), manufactured by the B. C. Ames Co., Waltham, Massachusetts 02154; or the Cady Pocket Micrometer, Model CPM (with .001" graduation), manufactured by E. J. Cady & Co., Chicago 60635.

71. Few bibliographers in the past have

utilized micrometer measurements of thickness to distinguish impressions. For an exception, see Matthew J. Bruccoli and Joseph Katz, "Scholarship and Mere Artifacts: The British and Empire Publications of Stephen Crane," *SB*, XXII (1969), 277-287 (esp. p. 278).

72. A micron (μ) is equal to one thousandth of a millimeter and is an appropriate unit for expressing the thickness of paper.

particular place on the edge of the book chosen for measurement. The center of the top edge is usually the best place to measure if a ruler is used, but calipers that reach in to the center of the leaves provide a more dependable reading; whichever method is employed, only those leaves comprising the sheets that went through the press are to be measured, excluding any endpapers and binder's leaves.⁷³

Even with these precautions, the measurement is not dependable enough to be relied upon in bibliographical analysis whenever much precision is required. If, for example, some copies of a particular book are printed on uniform paper throughout and other copies include one gathering made up of heavier paper, the variation in total bulk between copies of each kind may be so slight as to seem insignificant to the bibliographer; he may dismiss the variation (especially if he does not have copies yielding the two readings side by side) as due simply to the ways in which he held the copies when taking the measurements. But if he had taken micrometer readings of each sheet, he would have known that the variation resulted from the presence of a heavier sheet in some copies. Of course, chainlines and watermarks also serve to distinguish between papers in some books; but, for books printed on wove unwatermarked paper, micrometer measurement may be the only easy way of detecting mixed papers — and thus of locating what may be called "sheet-cancels" (substituted sheets rather than single leaves), not uncommon in machine-produced books.⁷⁴ Whenever a book does contain mixed papers, the figure for bulking thickness (as opposed to total bulk), if it is to have meaning, must be given separately for each different paper and must be based on the bulk of particular sections of the book; in such cases, dividing the total bulk of the entire book by the number of leaves gives only an average and tells one nothing about the bulking thickness of the individual papers involved. For this reason, figures for bulking thickness — when they are deemed significant enough to report — should be associated not with the figure for total bulk but with the other characteristics of the individual papers. A convenient way to put the figures for bulking thickness in proper perspective is to place them

73. See Bowers, *Principles*, p. 446.

74. Obviously leaf-cancels can often be located by micrometer measurements also, and one can argue for this reason that micrometer readings should be taken on every leaf of a book, not just on every sheet. One cannot rely on the detection of stubs as the sole method for finding cancels,

and chainlines and watermarks are not always present; micrometer measurements are therefore an invaluable aid in approaching the problem of cancels in machine-produced books printed on wove paper — a problem set forth by John Carter in "Some Bibliographical Agenda," in *Nineteenth-Century English Books* (1952), pp. 68-70.

immediately after the figures for the thickness of single sheets (with a parenthetical indication of the section of the book which served as the basis for the calculation): "thickness .076 mm. (B3), bulking .079 mm. (B-G)." The one figure for total bulk of the sheets should come later in the description, since it is a feature of the finished book, not a characteristic of any of the papers involved.

(2) *Color*. The most precise way of specifying color, in paper as in other objects, is in terms of spectrophotometric measurement; but a simpler — yet reliable and scientific — method, also used when appropriate in the paper industry, is visual comparison against a standard. Since the Centroid Color Chart worked out by the Inter-Society Color Council and the National Bureau of Standards has been recommended for other instances of color specification in bibliographical description,⁷⁵ it is an appropriate choice for the reporting of color in paper also. Certainly the same system of referring to color should be used throughout a bibliography, and the ISCC-NBS dictionary offers a convenient way of converting all specifications to the ISCC-NBS system regardless of the color chart originally employed. Furthermore, Deane B. Judd, writing in the *Paper Trade Journal*, has specifically shown the applicability of the ISCC-NBS names to the description of paper.⁷⁶ The advantages of the system, in terms of general acceptance and convenience, outweigh its two chief disadvantages: the glossiness of the centroid color chips and the limited distinctions the centroid chart makes among the common colors of printing papers. The two are related, for the less fine the discrimination required in specifying color, the less important the distortion created by surface texture. Of the 267 ISCC-NBS color-name blocks, only seven are of much use in describing the papers generally employed for printing books: white (Centroid 263), pinkish white (9), yellowish white (92), greenish white (153), bluish white (189), purplish white (231), and light gray (264). The colors of the majority of book papers, in fact, fall nearer the centroid chip for "white" than any of the other chips. Several methods of measuring and specifying more accurately the various degrees of whiteness in paper have been developed in the paper industry,⁷⁷ but under most circumstances the bibliographical significance of the precise color of paper is not great enough to war-

75. See G. T. Tanselle, "A System of Color Identification for Bibliographical Description," *SB*, XX (1967), 203-234.

for Paper," *Paper Trade Journal*, CXI (17 October 1940), TS201-TS206.

76. Judd, "Systematic Color Designations

77. For a brief list of works on this subject, see *SB*, XX (1967), 233.

rant the use of spectrophotometers and other elaborate equipment. In unusual instances the bibliographer may find it necessary to turn to these methods; but he need not make them part of his standard routine, for the information they yield would often prove more distracting than helpful to the readers of descriptive bibliographies. Ordinarily, therefore, the distinctions among near-whites provided by the ISCC-NBS centroid chips, though not subtle, are adequate for bibliographical purposes. Indeed, since the nearest match will usually be "white," a bibliographer may wish to establish the convention within an individual bibliography that all papers described are white unless otherwise specified; on the other hand, it does no harm to repeat "white" in each instance, since the word takes little space and emphasizes the fact that the color of the paper has been taken into account. It is perhaps unnecessary to cite the centroid number for white, but for other colors a parenthetical reference to a visual standard should always be provided. If a bibliographer describes a paper as "yellowish white (Centroid 92)," the reader knows that the color of the paper, though not necessarily an exact match, falls within that color-name block of which centroid chip 92 is representative.

(3) *Finish*. The finish of paper is one of its most prominent characteristics, involving such related properties as gloss, brightness, and smoothness. Since the general roughness or glossiness of a piece of paper immediately catches the eye, it is reasonable to expect that a description of paper should take this quality into account. The only accurate way of measuring gloss, however, is in terms of the surface reflectance of light, and the test for smoothness is in terms of the surface flow of air; these procedures again involve instruments which make finer discriminations than are generally usable or meaningful in a bibliography. What will usually suffice, for bibliographical purposes, is a simple verbal description of gloss and smoothness, preferably in the form of a single adjective (since the two qualities, except when measured by instruments, are difficult to separate). Although a standard series of adjectives exists in the paper trade — "antique," "eggshell," "vellum," "machine," and "English" (for uncoated papers), or "dull," "semidull," and "glossy" (for coated papers)⁷⁸ — any attempt to employ these terms without reference to a visual standard or recourse to numerical measurement would tend to accentuate the problem of subjectivity. Other similar series could be formulated — such as "very rough," "rough," "medium," "smooth,"

78. Definitions of these terms can be found in *The Dictionary of Paper* (3rd ed., 1965).

and "extra glossy"⁷⁹ — without reducing the difficulty of deciding where the lines between the categories should be drawn. Besides, would any two bibliographers agree on these lines, and could even a single bibliographer observe them consistently? Such considerations render impractical the attempt to establish on this level any multi-term sequence. Yet it is usually not difficult to secure agreement that certain papers are "rough" and others are "glossy." The most sensible course of action, therefore, is to use "rough" to describe uncoated papers which have a pronounced roughness and "glossy" to describe coated papers which have an unquestionably shiny surface; for all papers in between, whether coated or uncoated, one can use "smooth," or possibly no adjective at all, implying that only wide variations from the norm need be specified. Such a tripartite scheme does not eliminate subjective judgment but merely reduces the number of dividing lines where it must operate. When instruments or visual standards are not to be employed, it is futile to attempt subdividing a continuum into more than a few large sections if the results are to convey the same meaning to different people. For bibliographical purposes, distinguishing "rough" and "glossy" papers from the broad range in between is usually adequate and comprehensible; if a bibliographer needs on occasion to employ greater precision, he should turn to the appropriate instruments rather than increase his stock of adjectives and intensifying adverbs, which are more likely to confuse than to refine his description.⁸⁰

The specification of finish, like that of color and thickness, tends to have greater significance in connection with machine-made and wove papers than with handmade and laid papers. Variations in these characteristics in hand-produced paper, given the nature of the process, may be of little importance in distinguishing separate runs, whereas such variations in machine-made paper, with its greater regularity, may be of more consequence for identification; similarly, precise notation of these properties in laid (and particularly watermarked) paper may not be especially helpful, since the chainlines and watermarks generally provide sufficient identification, whereas such notation for wove (and particularly unwatermarked) paper may be quite useful,

79. This series is suggested by William Bond Wheelwright in "Identification of Paper Samples," *Paper & Printing Digest*, V (September 1939), 3-9.

80. Among the twentieth-century specimen books which offer samples of various finish-

es, two comprehensive ones are *A Book of Samples of Paper* (Champion Paper Co., 1922) and, especially, *Paper for Books: A Comprehensive Survey of the Various Types of Paper Used in Book Production* (Robert Horne & Co., 1953, 1961).

since there is little else to rely on. Thus the advantages of having detailed information about these characteristics rarely outweigh the difficulties of obtaining and utilizing it when the paper under examination is handmade, laid, or watermarked; for these papers the unsophisticated approach described here is often adequate. On the other hand, the usefulness of precise data about these matters may well justify the efforts entailed when the paper being analyzed is machine-made, wove, or unwatermarked; for these papers significant differences may be overlooked if precision instruments are not employed. All one can say is that any bibliographical description of paper should be expected to take some account of thickness, color, and finish. For the most part, the techniques used can be quite simple; but, when the occasion warrants, the bibliographer — aware of the more elaborate methods available to him — should not hesitate to turn to the laboratory for aid.

IV

All of these characteristics, which constitute the main part of a bibliographical description of paper, have to do with the *sheet*, not the *leaf* — that is, they are characteristics of the paper itself, not of the paper as it happens to be folded in a particular book (though some of them obviously must be inferred from the paper as folded). But at the end of the description two characteristics of the *leaf* — or the paper as it appears in the finished book — ought to be appended: the dimensions of the leaf⁸¹ and the total bulk of the leaves.⁸² These figures are important, first of all, because they represent direct measurements and thus serve as documentation for some of the inferences presented earlier in the description. In addition, being directly observable, they are sometimes of more immediate assistance to users of a bibliography than such figures as those for the dimensions and thickness of the sheet. Even for a book published before the time of edition binding, every copy of which may exhibit a different leaf size, a report of the leaf dimensions of the largest known copy is helpful, both to support the inference about sheet size and to serve as a conveniently usable standard of comparison. As for bulk, even though

81. Of course, if the format of a book cannot be determined and the dimensions of the leaf are given in the collation paragraph, they need not be repeated here.

82. The treatment of the edges (stained, rough-trimmed, and so on) is more appropriately specified in the paragraph on binding, since it is not a characteristic of the paper but represents something done to the paper in the process of binding.

it is difficult to obtain precise figures, sometimes two issues of a book differ so greatly in bulk that even approximate figures are adequate to distinguish them. For example, two issues of the first printing of O'Neill's *The Moon of the Caribbees and Six Other Plays of the Sea* (1919) can be distinguished by the paper: one bulks 18 mm. and the other 24 mm. The difference is pronounced enough that, even though the figures are not really precise, one has no difficulty in determining to which issue a particular copy belongs.⁸³ In this case the figures for total bulk are more immediately useful for identification than the information that the thickness of each sheet of one issue is .160 mm. and of the other .216 mm. Furthermore, if the bulking thickness were reported as .165 mm. for the first and .220 for the second, the figures for total bulk would be necessary to indicate the basis of the calculation. Leaf dimensions and total bulk, therefore, though not actually characteristics of paper itself, serve an important function in a bibliographical description of paper. Also, it is useful to record at this point, for laid paper, the direction of the chainlines in relation to the leaf.

The kinds of detail and the accuracy of measurement suggested here represent a somewhat fuller description of paper than is often found in bibliographies but clearly not the most elaborate description possible. Indeed, the procedure recommended here is intended to occupy a middle ground — detailed enough to provide information for identification and for historical study, and yet not so burdensome as to be self-defeating. It may be helpful to think of this procedure as occupying the middle stages in a series of graduated levels.⁸⁴ The lowest level, frequently employed in bibliographies in the past, is the simple designation of paper as either laid or wove. A second level, only slightly more detailed, includes a brief indication of any watermarks and perhaps a reference to color and finish. Although there will continue to be situations in which this brief sort of description is

83. Bulk measurements which include the covers and endpapers are cited for this book in Merle Johnson, *American First Editions*, ed. Jacob Blanck (4th ed., 1942), p. 401. Higginson's Graves bibliography reports two figures for bulk (as "1.8/2.3 cm."), one for the sheets and endpapers and another for the sheets, endpapers, and covers. However, bulk measurements should properly include only the sheets; if in rare instances a variation in the thickness of the covers is significant, the information

can be recorded in the paragraph on binding.

84. The idea of a series of levels to represent the spectrum of possible details for investigation was suggested by Kenneth L. Kelly's use of this device in "A Universal Color Language," *Color Engineering*, III (March-April 1965), 2-7; further comments on its usefulness in descriptive bibliography are found in the essay on "Tolerances" cited above (note 37).

binders' leaves, or the inserted advertisements in great detail, without ever mentioning the sheets on which the main text of the book is printed.

In addition to these reasons for the neglect of paper, there is the simple one of ignorance: bibliographers have not known what to say about paper. They have generally been able, of course, to distinguish between laid and wove, to use the direction of the chainlines for assistance in determining format, and to compare the general characteristics of each leaf for identifying cancels.⁵ But when it came to a description of paper in its own right, they could produce little more than a three-word phrase such as "white laid unwatermarked" — and even that, when included at all, was often inserted in a mechanical fashion, with seemingly little notion of the reasons for doing so. Paper-making is a complex field with an immense technical literature,⁶ and any bibliographer who is not also a specialist in the study of paper may be expected to feel somewhat uncomfortable in confronting the task of describing it. The situation is analogous to that faced by the bibliographer in describing typography: he may be able to utilize evidence from type for analysis without being able to say much directly about the type, owing to a lack of technical knowledge and vocabulary. But, since bibliographers historically have examined type faces more often than paper, their knowledge of types, however fragmentary, is generally greater than their knowledge of paper.

Nevertheless, many bibliographers have harbored a lingering uneasiness over this neglect, for in the back of their minds are always the classic examples of the use of paper evidence. As early as 1908, W. W. Greg discovered the false dating of the Pavier quartos of Shakespeare through a study of their watermarks;⁷ in 1934 John Carter and Graham Pollard exposed the Wise forgeries by analyzing the ingredi-

5. The classic discussion of cancels is R. W. Chapman's *Cancels* (1930).

6. The principal guide to the technical literature is *Pulp and Paper Manufacture: Bibliography and Patents* (edited, under various titles, first by Clarence J. West and then by Jack Weiner), which covers the period 1900-55 in five volumes and the years since 1955 in annual volumes; it includes — especially under the headings "History" and "Watermarks" — material of interest to bibliographers which is not always reported in the checklists that bibliographers more frequently consult. An-

other basic guide to this field is the *Abstract Bulletin of the Institute of Paper Chemistry* (1930-); a useful shorter collection of abstracts is Jack Weiner and Lillian Roth, *Paper and Its Relation to Printing* (Institute of Paper Chemistry Bibliographic Series No. 164; 2nd ed., 1962). A helpful selective checklist appears at the front of E. J. Labarre's *Dictionary and Encyclopaedia of Paper and Paper-Making* (2nd ed., 1952), pp. xi-xx.

7. Greg, "On Certain False Dates in Shakespearean Quartos," *Library*, 2nd ser., IX (1908), 113-131, 381-409.

sufficient, it cannot now be considered appropriate for a full-scale descriptive bibliography. Instead, the descriptive bibliographer will operate on one of the next two levels: the third, which entails direct measurements with a ruler (distances between chainlines, dimensions of watermarks, and total bulk and dimensions of the leaves); and the fourth, which involves inferences (to establish the dimensions of the sheets), recourse to reference works (to identify the watermarks), and use of a micrometer (to measure the thickness of individual sheets).⁸⁵ Beyond this level, two more may be postulated, but the bibliographer will move to them only in unusual cases: the fifth, in which the paper is subjected to one or more laboratory tests; and the sixth, in which the paper, on the basis of these tests, or reference to specimen books, or other research, is traced to an individual manufacturer or mill. The bibliographer who has examined a large number of copies of a given book will be best able to judge whether or not laboratory tests are worth investigating in that particular instance; though bibliographers in the past have been excessively reluctant to avail themselves of such assistance, it would be equally foolish to overestimate the value of laboratory tests for bibliographical work. As a general rule — subject to exceptions in special cases — what one can reasonably expect of a bibliographer in his description of paper is a level of detail equivalent to the fourth level described here.

After these characteristics of paper have been ascertained, there remains the problem of how best to record them in a descriptive bibliography. Since so little attention has been given to paper in the past, no accepted practice in this regard has become established. The only tradition which can be said to exist derives from the two major bibliographies which include paragraphs on paper, Gaskell's *Baskerville* and Stevenson's Hunt catalogue; their record of paper takes the following forms:⁸⁶

PAPER: Brownish, poor quality *Large Printing Demy* laid, watermark fleur-de-lys / IV, size of sheet 21 x 17¼ in.

PAPER: Crown, Genoese, with double chains, countermarked IV and

85. The degree of accuracy of measurements is a separate question from the quantity of detail. Generally speaking, dimensions of sheets and leaves, as well as total bulk, should be reported to the nearest millimeter (or the nearest thirty-second of an inch) and thicknesses of paper to the nearest thousandth of a millimeter (or of

an inch).

86. The first of these descriptions is from Philip Gaskell, *John Baskerville: A Bibliography* (1959), entry 37; the second is from Allan Stevenson, *Catalogue of Botanical Books in the Collection of Rachel McMaster Miller Hunt*, II (1961), entry 466.

corner OO. Plates in text: same paper. Frontispiece: thick paper with single chains, countermarked IV. Leaf 13.1 x 8.6" = sheet [14 x 18"].

This pattern — the size-name of the paper, followed by a designation of chainlines and marks, with the leaf measurement at the end — is the basis for the sample forms presented below. They are purely hypothetical examples, designed to suggest ways of handling a variety of situations:

PAPER. *Sheets*: at least 500 x 376 mm. (probably Crown, 508 x 381); laid, with dolphin mark (Briquet 5873), 35 x 1[23]1 (B4) / 0[23]2 (G3), and countermark 'IV', 10 x 6[13]6 (B1); thickness .244 (B4), bulking .250 (B-P); light gray (Centroid 264). *Plates*: laid, chainlines 22 mm. apart; thickness .272; light gray. *Leaves*: at least 376 x 250 (B4); chainlines vertical; total bulk 14 mm.

PAPER. *Sheets* (A-D, I-M): wove, unwatermarked; thickness .203 mm. (I1), bulking .207 (I-M); bluish white (Centroid 189); glossy. *Sheets* (E-H): wove, unwatermarked; thickness .221 (E1), bulking .227; white (263); glossy. *Frontispiece*: wove, unwatermarked; thickness .279; bluish white; glossy. *Leaves*: total bulk 20.5 mm.

The first represents a book which is printed on laid watermarked paper and for which the format can be determined; the second represents one which is printed on two kinds of wove unwatermarked paper and for which the format is not known. Various modifications will naturally suggest themselves in particular instances. It is more important, of course, to be concise, unambiguous, and consistent within a given bibliography than to follow uncritically a form prescribed in advance; on the other hand, in the absence of special difficulties, a prescribed form is to be preferred over individual variations, since it leads to greater uniformity among bibliographies in general and thus to greater ease of reference.

The approach to the description of paper suggested here would not, in most cases, involve a great investment of time, nor would the resulting paragraph occupy much space on the printed page. Yet the information amassed in this way — particularly after a large number of bibliographies had recorded such details — would be of incalculable value to the historian of paper and of book production; and a descriptive bibliography cannot be said to have fulfilled its function unless it provides this kind of historical data. In any event, paper is a major ingredient of the printed book, and it is only common sense to expect a description of a book to include some comments on paper. There are signs that more bibliographical attention is now beginning to turn

in this direction. Even the technical research into paper deterioration has given some impetus to the historical study of nineteenth-century paper⁸⁷ and has caused certain present-day publishers to include in their colophons the results of various paper tests.⁸⁸ And Allan Stevenson's work has dramatically demonstrated to bibliographers that the investigation of paper can play a significant role in bibliographical analysis. A bibliographer cannot know just what aspects of paper are going to take on greater importance for analysis in the future but by recording certain basic facts about size, watermarks, thickness, and the like he can help to accumulate the data upon which new discoveries will rest. The descriptive bibliographer is a historian, and one measure of his success is the extent to which he gives paper — like any other element of the book — its rightful place in the total picture.⁸⁹

87. See, for example, *Strength and Other Characteristics of Book Papers, 1800-1899* (1967), Publication No. 5 in the series on *Permanence/Durability of the Book* (1963-), issued by the W. J. Barrow Research Laboratory of Richmond, Va.

88. A recent example occurs in *The National Union Catalog: Pre-1956 Imprints* (1968-), where the paper on which the

work is printed is described in this fashion: "Substance 89 gsm / pH cold extract 9.4 / Fold endurance (MIT 1/2 kg. tension) 1200 / Tear resistance (Elmendorf) 73 (or 67 x 3) / Opacity 90.3%."

89. I am grateful to the late Allan Stevenson and to Dr. Philip Gaskell for their generosity in taking time to read a manuscript version of this article.

ents of the paper;⁸ and, most recently, Allan Stevenson has conclusively dated the so-called "Constance Missal" by comparing the states of the watermarks in it with occurrences of those watermarks in other books.⁹ These are the spectacular achievements, but during the last thirty years there have also been several encouraging indications that increasing attention is being directed toward the description of paper as a routine part of bibliographical investigation. In 1942 A. T. Hazen said, in his introduction to *A Bibliography of the Strawberry Hill Press*, "I have paid special attention to the paper on which the books and Detached Pieces are printed; possibly to some people the development of this method will be the most interesting part of the book" (p. 10); and he proceeded, in the first entry, to prove that the thick-paper copies of Gray's *Odes* (1757) were printed in 1790 or later (pp. 24-29). Then in 1949 Fredson Bowers, in his *Principles of Bibliographical Description*, recommended that a paragraph on "Typography and Paper" be a standard part of a description (pp. 444-446);¹⁰ a decade later two outstanding bibliographies appeared which included separate paragraphs on paper in each entry — Philip Gaskell's *John Baskerville: A Bibliography* (1959) and Allan Stevenson's *Catalogue of Botanical Books in the Collection of Rachel McMasters Miller Hunt*, Volume II (1961). And during the last two decades Stevenson, in many essays, has singlehandedly evolved a methodology for the bibliographical analysis of paper and has demonstrated the uses to which that analysis can be put.

There can by this time be no doubt that a bibliographer's routine examination of a book is deficient if it does not include an analysis of paper as well as of type-impressions. The descriptive bibliographer is then faced with the question of how much of the information turned up in such analysis ought to be recorded in a descriptive bibliography. If a bibliography is regarded simply as a handbook for the identification of particular impressions or states, then only those facts would be reported which serve to distinguish impressions or states — the usual practice in the past. But if a bibliography is to take on its proper

8. Carter and Pollard, *An Enquiry into the Nature of Certain Nineteenth-Century Pamphlets* (1934), esp. pp. 42-55 ("The Analysis of the Paper").

9. Stevenson, *The Problem of the Missale speciale* (1967).

10. Also, at roughly this time, Henry Thomas expressed the need for a "hand-

book" of paper study, particularly the use of watermarks in bibliographical analysis; see "Watermarks," *Edinburgh Bibliographical Society Transactions*, II (1938-45), 449-450. And James G. McManaway, in his contribution to *Standards of Bibliographical Description* (1949), commented on the neglect which paper study had suffered (p. 68).

function and serve as a history of the forms in which an author's works have appeared and thus as a partial history of the book trade, details about paper become an important part of the descriptions, whether or not they furnish "points" for the recognition of impressions or states. The usefulness of paper evidence and the description of paper, though separate matters, are obviously related. As more descriptive bibliographers take seriously the responsibility of furnishing careful descriptions of paper, the store of information amassed in this way will become correspondingly more valuable as an aid to further investigation; conversely, progress in the bibliographical analysis of paper can only be slow if bibliographers, whenever they examine a book, do not contribute to that store of information by recording the characteristics of the paper as they observe them.

It should go without saying, in other words, that a descriptive bibliography, if it is adequately to describe certain books as physical objects, is obligated to include some description of the paper used in those books. But bibliographers have no place to turn for detailed instructions about which features to record, how to present them, and how to vary the treatment so as to preserve the overall proportions of the description. A standard procedure for these matters is desirable, both to insure balanced coverage in the recording of information and to facilitate later reference to the information. The present state of research on paper — though much work remains to be done — is sufficiently advanced that it does not seem premature to begin thinking about such a procedure. I shall attempt, in the pages that follow, to draw together some of the previously formulated techniques for the description of paper and to make a few preliminary suggestions for presenting the material in a descriptive bibliography.

I

One of the basic physical attributes of any object is its size, and the dimensions of the sheets of paper used in the production of a book naturally constitute one of the most important characteristics of that paper. Obviously the bibliographer, in order to determine those dimensions, cannot simply measure the sheet directly, since in most cases he has before him a copy of a finished book, in which the dimensions of the sheet have been obscured through folding and perhaps trimming. Specifying the dimensions of the original sheet can come only through the process of analyzing the evidence present in the finished book; even if the bibliographer has access to external documents (such as printers' or publishers' records) which list the size of

the paper, he must still check the accuracy of the documents by examining the physical evidence.

A consideration of the sizes of paper used in books therefore necessarily involves the question of format.¹¹ As a concept, of course, format has nothing directly to do with size, for it is merely an indication of the number of leaves which result from the folding of a sheet, whatever the size of the sheet. Quarto format means that a sheet has been folded twice to produce four leaves, but the term implies nothing about the dimensions of the sheet or the resulting leaves.¹² The designation of format in a bibliographical description, according to the Greg-Bowers formulary, is the first element in the collation line, not part of the description of paper: format is not one of the properties of paper but represents something done to the paper. However, since the bibliographer can measure directly only the dimensions of a leaf, he must know the format if he is to arrive at the size of the unfolded sheet. There will be many instances in which he has insufficient evidence to establish the format, and in these cases all he can give is the leaf measurement; but whenever the format can be discovered, he should provide an indication of the sheet, as well as the leaf, measurement.

The use of certain characteristics of paper, such as chainlines and watermarks, to assist in determining the format of a book was one of the earliest techniques of bibliographical analysis. William Blades explained the method in the *Library* in 1889,¹³ and further instructions appear in any of the introductory manuals of bibliography, such as those of McKerrow and Esdaile.¹⁴ Many people, even with only a

11. An important treatment of the general subject is Graham Pollard, "Notes on the Size of the Sheet," *Library*, 4th ser., XXII (1941-42), 105-137. See also Lawrence Wroth, "Formats and Sizes," *Dolphin*, I (1933), 81-95; and David Foxon, "Some Notes on Agenda Format," *Library*, 5th ser., VIII (1953), 163-173.

12. Nor about the number of leaves in a gathering, for a gathering can consist of half a sheet or of several sheets and still represent the same format (the same number of leaves per full sheet). For some discussion of the distinctions among format, signature, gathering, and size, see John R. Hetherington, "Signatures and Sizes," *Times Literary Supplement*, 14 October 1965, p. 928; and G. T. Tanselle, "The

Sizes of Books," *AB Bookman's Weekly*, XXXIX (5-12 June 1967), 2330, 2332. Methods of analysis for detecting half-sheet gatherings are taken up in William H. Bond, "Imposition by Half-Sheets," *Library*, 4th ser., XXII (1941-42), 163-167; Luella F. Norwood, "Imposition of a Half-Sheet in Duodecimo," *Library*, 5th ser., I (1946-47), 242-244; and Kenneth Povey, "On the Diagnosis of Half-Sheet Impositions," *Library*, 5th ser., XI (1956), 268-272.

13. Blades, "On Paper and Paper-Marks," *Library*, 1st ser., I (1889), 217-223.

14. R. B. McKerrow, *An Introduction to Bibliography for Literary Students* (1927), pp. 164-174; Esdaile's *Manual of Bibliog-*

slight knowledge of bibliography, are acquainted with the well-established rules: vertical chainlines, watermark in the center of the leaf, and large rectangular shape signify folio; horizontal chainlines, watermark centered at the gutter in two leaves, and squarish shape signify quarto; vertical chainlines, watermark at the top edge of the gutter in four leaves, and rectangular shape signify octavo; and so on. It is true that this system will serve to identify the format of the large majority of books printed before the nineteenth century,¹⁵ but there are instances in which it does not apply. For one thing, the procedure assumes that chainlines always run parallel to the shorter dimension of the original sheet and that the principal watermark is placed in the center of one half of the sheet. Actually, it is more accurate to say that chainlines run parallel to the shorter dimension of the *mould*; sometimes large moulds were used to produce either double-size paper or two sheets side by side, with the result that the half-sheets or individual sheets — though the size of ordinary sheets — had chainlines running in the opposite direction from those in ordinary sheets.¹⁶ Examples of these “turned chainlines,” as they have been called, are not uncommon from the late seventeenth century onward, and bibliographers must keep the possibility in mind when determining format. But even though one recognizes turned chainlines, one cannot always be sure whether the original sheet was one of double size (cut in two before printing) or one of two separate sheets produced in the same mould. The pattern of deckle edges would of course settle the question, but for books of this period — before the introduction of publishers’ binding — one rarely encounters copies which have not been trimmed down in the course of binding and rebinding, thus destroying the evidence which the deckle edge could provide.¹⁷ When the

raphy, rev. Roy Stokes (4th ed., 1967), pp. 237-244; Paul S. Dunkin, *How to Catalog a Rare Book* (1951), pp. 31-56.

15. In rare cases additional kinds of evidence may turn up, such as the printed lines which showed the binder where to make the cut-off in duodecimo; see Giles E. Dawson, “Guide-Lines in Small Formats (About 1600),” *SB*, XIV (1961), 206-208.

16. See A. T. Hazen, “Eighteenth-Century Quartos with Vertical Chain-Lines,” *Library*, 4th ser., XVI (1935-36), 337-342; and Kenneth Povey and I. J. C. Foster,

“Turned Chain-Lines,” *Library*, 5th ser., V (1950-51), 184-200. Several books from the fifteenth century have been noted in which some leaves appear to represent different formats from other leaves, as a result of certain sheets having been cut in half (or quartered) before printing; see Curt F. Bühler, “Chainlines versus Imposition in Incunabula,” *SB*, XXIII (1970), 141-145.

17. If one could count on the presence of a single main watermark in the center of one half of every sheet, whether a double sheet or one of the companion

matter cannot be settled conclusively, the clearest course is to follow Bowers's recommended procedure and use such a phrase as "(4°-forme) 8°" — meaning that the book has most of the characteristics of a quarto but is octavo in the sense that the amount of paper for eight of its leaves was in the mould at one time.¹⁸ As for watermarks, their positions, too, can sometimes vary from the normal;¹⁹ if, therefore, all the evidence except the watermark points to a particular format, the position of the watermark does not necessarily disprove it. Finally, the usual method presupposes the presence of chainlines and watermarks, but some books printed in the late eighteenth century, when the use of wove paper was increasing, do not offer these aids to bibliographers.

In the case of later books, it is not the frequent absence of chainlines and watermarks which causes the chief difficulty in determining format but rather the widespread use of machine-made papers. Before the introduction of paper-making machines early in the nineteenth century, the size of sheets was limited to the size of the mould which one man could pick up; but after the technological revolution, which produced presses that could print larger sheets and machines that could manufacture them, the sizes of sheets used for books showed much greater variety. In addition, any chainlines present in machine-made paper are of no use for analysis since they are not a natural result of the manufacturing process but merely a design impressed upon the paper. Of course, whenever nineteenth- and twentieth-century books have been printed on handmade paper with chainlines, the standard method of analysis can be used just as effectively as for pre-1800 books;²⁰ but the point is that for the majority of books of these two centuries the traditional procedure is of no help. A modern book, for example, may have the same general shape as an old octavo and may even be gathered in eights, but it may well have been printed on quad sheets, each of which furnished four eight-leaf gatherings, so that the format is 32°. Although the number of leaves in a gathering cannot be taken in the books of any period as an indication

sheets from a double mould, one could use watermarks as a guide; but the lack of regularity in the placing of watermarks makes this test unreliable.

18. Bowers's discussion of turned chainlines is in *Principles*, pp. 193-195. A related example is taken up in Richard J. Wolfe, "*Parthenia In-Violata: A Seventeenth-Century Folio-form Quarto*," *BNYPL*, LXV

(1961), 347-364.

19. See Edward Heawood, "The Position on the Sheet of Early Watermarks," *Library*, 4th ser., IX (1928-29), 38-47.

20. Although handmade papers can be made in unusually large sizes by having more than one man manipulate the mould.